82219

S/031/60/000/006/002/004

The Effects of Vanadium on the Properties of Industrial Nickel-Base Alloys

nadium slightly raised the electric resistance of both alloys, and increased their strength and plasticity at all temperatures in the tests. The most remarkable effect of the vanadium, in the opinion of the authors, was that on the plasticity of the alloys. At 400 - 800°C this increase was 1.5 - 2 times, a fact of great scientific interest which makes it possible to reduce or even entirely eliminate the temperature zones of brittleness of nickel alloys by alloying them with small quantities of vanadium and certain other rare metals. The authors recommend more extensive tests on the effect of vanadium on nickel-based alloys. Conditions and results of the tests are shown in tables and graphs. There are 4 tables, 2 figures and 3 references: 2 Soviet and 1 French.

4

Card 2/2

81430
S/030/60/000/06/07/043
B004/B008

5.2300

AUTHOR: Savitskiy, Ye. M., Professor

TITLE: Metals of Rare Earths and Prospects of Their Use in Industry

PERIODICAL: Vestnik Akademii nauk SSSR, 1960, No. 6, pp. 81-88

TEXT: The author sets out from the fact that the utilization of rare earths (RE), accumulating as secondary substances due to the increase in production of thorium, titanium, niobium, and tantalum, has become a problem of national economy. After a survey of the electronic shell of RE and its chemical and physical properties, the author states that the metals of the cerium subgroup may be utilized as alloy admixtures in metallurgy, those of the yttrium group for the manufacture of alloys with special physical properties. The properties of RE are investigated in the Soviet Union by the Laboratoriya redkikh metallov Instituta metallurgii im. A. A. Baykova Akademii nauk SSSR (Laboratory of Rare Metals of the Institute of Metallurgy imeni A. A. Baykov of the Academy of Sciences, USSR). Yttrium can be used in the construction of nuclear reactors since it does not react with uranium and plutonium, and possesses

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81430
S/030/60/000/06/07/043
B004/B008

Metals of Rare Earths and Prospects of Their Use in Industry

a low coefficient of capture of thermal neutrons. Isotopes of gadolinium, samarium, europium, and dysprosium, however, possess a high capture coefficient, and would be suitable as components of cermets or alloys for the regulation of atomic reactors. The author mentions his investigations of phase diagrams of systems of RE and Mg, Al, Cu, Fe, Ti, Cr, Nb, and V. He presents the phase diagram Mg - Nd, and the fine structure of the Mg-Nd alloys (Fig. 1). He mentions the influence of RE on the properties of electrolyte iron (Fig. 2) and their use as modifiers of iron and steel due to their chemical activity (binding of the oxygen). The oxygen is bound in chromium alloys by RE, and the size of crystals is strongly reduced. The phase diagram Ti - Ce (Fig. 4) as well as the increase in thermal stability of titanium through lanthanum and cerium are discussed. Niobium becomes plastic at an addition of 0.3-0.5% of Ce, and can be rolled into strips. The effect of Ce on vanadium is similar. The addition of 0.1% of Ce to ЛС 59-1 (LS 59-1) brass (59% of Cu, 40% of Zn, 1% of Pb) converts it at 750°C into a superplastic state. Chrome-nickel- and iron-chromium-aluminum alloys are protected from oxidation by an addition of 0.5% of Ce. An alloy of 25% of Cr, 3% Al,

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81430

Metals of Rare Earths and Prospects of Their Use in Industry

S/030/60/000/06/07/043
B004/B008

1% Y (rest iron) can be molten in the air without oxidizing. There are 4 figures.

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80973

S/136/60/000/07/016/024
E073/E235

18.6100

AUTHORS: Savitskiy, Ye. M., and Vlasov, A.I

TITLE: Sintered Copper Powder.

PERIODICAL: Tsvetnyye metally, 1960, Nr 7, pp 72-77 (USSR)

ABSTRACT: The authors investigated the structure, electric resistance and the mechanical properties of sintered copper powder with additions of oxides of aluminium, silicon and magnesium, using as starting materials powders with characteristics as given in Table 1. The mixture for obtaining sintered copper powders were prepared by simple mechanical mixing of the appropriate powders of copper and oxides. The mixing was effected in steel ball mills by the wet method with a ball to charge ratio of 5:1 and a mixing time of 48 hours. Copper powder mixtures containing 1, 3 and 5 vol % each of aluminium and silicon oxides and 1, 3, 5 and 10 vol % of magnesium oxide were used. The mixtures were subjected to hydrogen reduction at 350°C for a duration of 30 mins and from these, specimens of 80 mm diameter, 110 to 120 mm height were produced by hydrostatic pressing with a pressure of 1000 kg/cm^2. The presslings

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S/136/60/000/07/016/024
E073/E235

Sintered Copper Powder

were sintered in the hydrogen atmosphere with a slow rise in the temperature of 1000°C holding the presslings at this temperature for a duration of 3 hours. The sintered blanks, 70 mm diameter, were extracted at 800°C into rods of 21 mm diameter, which were annealed at 400°C for a duration of 1 hour. Further investigations were carried out on pressed and annealed specimens. Table 1 gives data on the characteristics of the powders used for preparing the mixture. Table 2 gives data on the density and the electric conductivity of the investigated specimens. Fig 1 shows microstructure photographs of sintered powder containing 1% Al_2O_3 taken with magnification of 1500 and 8800 respectively. Fig 2 shows plots of the dependence of the hardness on the annealing temperature for copper and sintered copper powder containing respectively 5, 3 and 1% Al_2O_3. Fig 3 shows plots of the dependence of the hardness on the annealing temperature for copper and sintered copper powder containing respectively 10, 5, 3 and 1% MgO. Fig 4 shows plots of the dependence of the UTS of sintered copper powder as a function of the percentual

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E073/E235

Sintered Copper Powder

contents of Al_2O_3 and MgO at temperatures of 20, 400, 600 and 800° respectively. Fig 5 shows plots of oxidation of copper and of sintered copper powders at various temperatures. It is stated that the strength of sintered copper powder specimens containing oxides and produced by the method described in this paper exceeds considerably the strength of copper both at room temperature and at temperatures up to 800°C. The strength of sintered copper powder containing Al_2O_3 exceeds by a factor of 1.5 the strength of copper in the temperature range 20 to 800°C; the hardness exceeds the hardness of copper by a factor of 2 to 3. Addition of oxides to copper increases its recrystallisation temperature from 300 to 600-700°C; sintered copper powder does not soften after heating it to the above mentioned temperatures. The electric conductivity of sintered copper powder containing 1 and 3 vol % Al_2O_3 is 87 to 93% of the electric conductivity of copper. The resistance to scaling of the sintered copper powder is also higher than that of copper. The best results are

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E073/E235

Sintered Copper Powder

obtained with sintered copper powders containing additions of Al_2O_3, whereby the values of the strengths and hardness are higher in the case of using high disperse oxides with a maximum uniformity in their distribution in the volume of the component. Components made of this material can be used advantageously in those branches of engineering where high temperature copper alloys are being used. There are 5 figures, 2 tables and 6 references, 4 of which are Soviet and 2 English.

ASSOCIATION: VNIITS

Card 4/4

83240

S/129/60/000/009/005/009
E193/E483

9.4174
9.4100 9.2140

AUTHORS: Savitskiy, Ye.M., Doctor of Technical Sciences, Professor, Tylkina, M.A., Candidate of Technical Sciences, Ipatova, S.I. and Pavlova, Ye.I., Engineers

TITLE: The Properties of Tungsten-Rhenium Alloys

PERIODICAL: Metallovedeniye i termicheskaya obrabotka metallov, 1960, No.9, pp.20-25

TEXT: Following their earlier study of the constitution diagram of the tungsten-rhenium system (Ref.7), the present authors conducted a series of experiments to study the effect of rhenium additions (up to 20%) on various properties of tungsten. All tests were conducted on wire specimens, prepared by powder metallurgy technique. The following conclusions were reached: 1) The temperature of the beginning of recrystallization of tungsten was raised by 200 to 400°C by addition of rhenium, depending on the precise quantity added; 2) Strength and plasticity of tungsten, in the 20 - 3000°C temperature range, are increased by rhenium additions; 3) A wire, made of tungsten-rhenium alloy, is characterized by high strength and plasticity after annealing at 1400 to 1950°C. An alloy, containing 20% rhenium

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83240

S/129/60/000/009/005/009
E193/E483

The Properties of Tungsten-Rhenium Alloys

and annealed at 1400 to 1500°C has U.T.S. equal 180 to 190 kg/mm^2 and elongation of 18 to 20%; 4) Hardness of tungsten-rhenium alloys at 20 - 1000°C is also higher than that of pure tungsten, the hardness of the alloys with more than 10% rhenium at 800°C is 200 kg/mm^2 against 110 kg/mm^2 for alloys containing less than 10% rhenium; 5) The electrical resistivity of tungsten at various temperatures is increased several times by addition of rhenium; 6) The results of the present investigation indicate that the tungsten-rhenium alloys can be used in the manufacture of various parts of vacuum tubes, thermocouples and electrical contacts. There are 5 figures and 10 references: 6 Soviet, 2 English and 2 German.

ASSOCIATION: Institut metallurgii AN SSSR, Moskovskiy elektrolampoviy zavod (Institute of Metallurgy AS USSR. Moscow Electric Lamp Plant)

Card 2/2

84675
S/136/60/000/011/008/013
E021/E406

18.0010

AUTHORS: Savitskiy, Ye.M., Terekhova, V.F. and Burov, I.V.

TITLE: Gadolinium and its Alloys

PERIODICAL: Tsvetnyye metally, 1960, No.11, pp.59-64

TEXT: The gadolinium used in this investigation was produced by reduction of its fluoride with calcium. It was then distilled from a tantalum crucible and contained the following impurities: 0.1% terbium, 0.1% yttrium, 0.02% calcium, 0.03% iron and 0.1% copper. Its specific weight determined by the hydrostatic method was 7.90 and from X-ray data 7.85. Its melting point was 1325 ± 5°C. It was found to have the following mechanical properties: Brinell hardness - 60 kg/mm^2; tensile strength - 21.7 kg/mm^2; yield point 20.5 kg/mm^2; compression strength - 52.5 kg/mm^2; tensile elongation - 2%. Other properties of gadolinium were electrical resistance at 20° - 140 x 10^{-6} ohm cm. Saturation in the field of 10000 oersteds, $4\pi I_s$ = 22000 gauss at -196°C (a curve of $4\pi I_s$ against H at -196°C is shown in Fig.4). Curie temperature - 17.7°C. The crystal structure of gadolinium is close packed hexagonal with a = 3.63 ± 0.01 kX, c = 5.79 ± 0.01 kX and c/a = 1.59 ± 0.01. Preliminary work on iron-gadolinium alloys

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S/136/60/000/011/008/013
E021/E406

Gadolinium and its Alloys

has shown that gadolinium forms narrow regions of solubility in both α and γ iron and narrows the region of existence of the γ modification. The compound $Fe_{17}Gd_2$ (24.8 wt.% gadolinium) is formed and it is similar to Th_2Zn_{17}. Alloys with higher than 7 to 8 wt.% gadolinium are brittle at room temperature. Gadolinium forms a wide range of solubility with magnesium (at room temperature 3 to 5 wt.%). The system has a eutectic point at 28% gadolinium and 540°C. Nickel-gadolinium alloys are easily deformed in the hot condition. The microstructures of pure gadolinium (Fig.1), iron-gadolinium alloys (Fig.5), magnesium-gadolinium alloys (Fig.6) and nickel-gadolinium alloys (Fig.7) are shown. There are 7 figures, 1 table and 11 references: 5 Soviet, 1 French and 5 English (one of which is translated into Russian).

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SAVITSKIY, Ye, prof.

High-strength cast iron. NTO 2 no.3:16-18 Mr '60. (MIRA 13:6)

1. Predsedatel' vremennoy komissii Gosudarstvennogo nauchno-tekhnicheskogo komiteta SSSR po tseriyevomu modifikatoru chuguna.
(Cast iron)

SOV/78-5-1-43/45

5(2)

AUTHORS: Terekhova, V. F., Markova, I. A., Savitskiy, Ye. M.

TITLE: Alloys of Magnesium With Yttrium

PERIODICAL: Zhurnal neorganicheskoy khimii, 1960, Vol 5, Nr 1, pp 235-236 (USSR)

ABSTRACT: The authors investigated the influence exerted by yttrium upon the properties of magnesium and plotted the phase diagram for the system Mg - Y, on which there are no data available. They studied the macrc- and microstructure of 19 alloys with an yttrium content of up to 55%, carried out the thermal analysis, and measured their hardness. Figure 1 shows the microstructure of magnesium alloys with different yttrium content. Figure 2 illustrates the phase diagram recorded by a Kurnakov pyrometer, and represents the dependence of microhardness on the content of the second component. In alloys with more than 40% of yttrium, a compound of Mg with Y (probably Mg_3Y) was formed, whose crystallographic data were determined by P. I. Kripyakevich and Ye. I. Gladyshevskiy. The phase diagram shows that it is similar to the earlier investigated diagrams of the

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69058

18.1225

S/078/60/005/03/045/048
B004/B005

AUTHORS: Savitskiy, Ye. M., Burkhanov, G. S.

TITLE: The Phase Diagram and the Properties of the Alloys of the System Titanium - Neodymium

PERIODICAL: Zhurnal neorganicheskoy khimii, 1960, Vol 5, Nr 3, pp 751-753 (USSR)

ABSTRACT: The authors report on their preliminary results of investigation of the system Ti - Nd. Nine alloys with 0 - 10% of Nd were investigated. To stabilize the state of alloys at high temperatures, quenching in water was done at 600, 800, 850, 890, 920, 1000, and 1100°. Figure 1 shows the microstructures. An addition of neodymium stabilizes the α-phase. In the system Ti - Nd, no compounds of the two metals were detected in the range investigated. The measurement of the microhardness of the α-phase (Fig 2) shows that the maximum solubility of Nd in Ti at 600° is 1.8% by weight. The phase diagram is shown by figure 3. Further, the Brinell hardness (Table 1), the elongation, and the endurance (Fig 4) were measured. Neodymium increases the hardness and endurance of titanium considerably and more intensively than lanthanum and cerium, small additions exerting almost no influence on plasticity. As the solubility of neodymium in α-titanium depends very much on tempera-

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The Phase Diagram and the Properties of the Alloys of the System Titanium - Neodymium

S/078/60/005/03/045/048
B004/B005

ture, signs of aging have to be expected. This assumption, however, will have to be confirmed by experiment. There are 4 figures, 1 table, and 9 references, 8 of which are Soviet.

ASSOCIATION: Institut metallurgii Akademii nauk SSSR (Institute of Metallurgy of the Academy of Sciences, USSR)

SUBMITTED: August 19, 1959

APPROVED FOR RELEASE: 03/14/2001 CIA-RDP86-00513R001447410020-8"

S/078/60/005/03/046/048
B004/B005

AUTHORS: Savitskiy, Ye. M., Terekhova, V. F., Kholopov, A. V.

TITLE: The Phase Diagram of the Alloys of the System Chromium - Lanthanum

PERIODICAL: Zhurnal neorganicheskoy khimii, 1960, Vol 5, Nr 3, pp 754-755 (USSR)

ABSTRACT: The authors report on their investigation of the phase diagram of the system chromium - lanthanum up to a content of 30% of La by weight. Lanthanum exerts a modifying effect on chromium (microstructures, Fig 1). The maximum solubility of lanthanum in chromium is 1.5% by weight. In alloys with 10, 15, 20, and 30% of La by weight, a dissociation was observed in the liquid and in the solid phase. Chemical compounds of the two components were not detected. The broad zone of immiscibility is characteristic of the phase diagram (Fig 2). It is due to the great difference in atomic radii of Cr and La. There are 2 figures and 4 Soviet references.

Inst. Metallurgii im. A.A. Baykov, AS USSR

69059

18.1275

S/078/60/005/03/047/048
B004/B005

AUTHORS: Savitskiy, Ye. M., Kopetskiy, Ch. V.

TITLE: Physicochemical Interaction Between Manganese and Niobium

PERIODICAL: Zhurnal neorganicheskoy khimii, 1960, Vol 5, Nr 3, pp 755-757 (USSR)

ABSTRACT: It was the object of this paper to draw the phase diagram Mn - Nb up to a content of 30% by weight of Nb. Alloys with a niobium content of 2.26, 2.97, 5.6, 5.64, 16.65, 17.56, and 29.85% by weight were investigated. The niobium was introduced into the alloys as 40-50% ligature with Mn. An investigation of the microstructures(Fig 1) proves the formation of a eutectic at about 5.64% of Nb by weight. The X-ray analysis confirmed the results of the investigation of the microstructures. Beginning with 5.64% of Nb, the Debye patterns show lines of a new phase which belong to the compound Mn_2Nb with a structure of the $MnZn_2$ type. The lattice constants of this compound are indicated. The microhardness of the compound Mn_2Nb checked by a TP-apparatus amounts to 768 kg/mm^2, and is lower than the microhardness of the solid niobium solution in manganese (1020 kg/mm^2). An increasing niobium content reduces steadily the microhardness down to 650 - 700 kg/mm^2

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Physicochemical Interaction Between Manganese and Niobium

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B004/B005

for the alloy with 29.85% of Nb. The thermal analysis shows that the niobium addition increases the temperature of the $\alpha \rightharpoonup \beta$ transformation from 727° (pure Mn) to 800° (alloy). At further temperature increase, the $\beta \rightharpoonup \gamma$ transformation takes place (1135°), the eutectic mixture of γ-manganese with Mn_2Nb melts at 1220°. The δ-modification of manganese was not observed. The pure compound Mn_2Nb melts at 1500°. The phase diagram (Fig 2) was drawn on the basis of the experimental data. There are 2 figures and 3 references, 1 of which is Soviet.

ASSOCIATION: Institut metallurgii im. A. A. Baykova Akademii nauk SSSR (Institute of Metallurgy imeni A. A. Baykov of the Academy of Sciences, USSR)

SUBMITTED: October 28, 1959

Card 2/2

87804

S/070/60/005/006/002/009
E032/E314

21.1320

AUTHORS: Gladyshevskiy, Ye.I., Tylkina, M.A. and Savitskiy, Ye.M.

TITLE: X-ray and Microscopic Study of Hf-Re Alloys

PERIODICAL: Kristallografiya, 1960, Vol. 5, No. 6, pp. 877 - 881

TEXT: A study is reported of phase equilibria in alloys of rhenium and hafnium containing 66% of Hf by weight. The existence of four compounds has been established and the crystal structure of two of them has been determined (Hf_5Re_{24}, structural type: Ti_5Re_{24}, a = 9.713 ± 0.005 Å; $HfRe_2$, structural type: $MgZn_2$, a = 5.248 ± 0.001 Å, c = 8.592 ± 0.002 Å, c/a = 1.637. The compound He_5Re_{24} (microhardness measured with a load of 100 g to an accuracy of 40 kg/mm^2 was H_μ = 1130 kg/mm^2) in cast specimens is

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X

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E032/E314

X-ray and Microscopic Study of Hf-Re Alloys

found to be in equilibrium with rhenium (H_{μ} = 760 kg/mm^2). X-ray data for annealed alloys with a large concentration of rhenium indicate the presence of a phase "A" of unknown composition of structure. The microhardness of $HfRe_2$ was found to be 1 460 kg/mm^2. In cast alloys containing 33 and 50 at.% Re in equilibrium with the solid solution based on the cubic body-centred modification of hafnium (β-Hf), a further phase of unknown structure (B) was detected. The latter phase is probably Hf_2Re and its microhardness is 1980 kg/mm^2. Table 1 gives the phase composition of the HfRe alloys:

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E032/E314

X-ray and Microscopic Study of Hf-Re Alloys

Concentration of rhenium, % by wt.	Concentration of rhenium, at. %	Microhardness (cast alloys)	Phase Composition of alloys: Cast	Phase Composition of alloys: Annealed at 1000°C for 150 hrs
99	99.0	Heterogeneous	Re+trace Hf_5Re_{24}	Re+A
97	96.8	"	$Re+Hf_5Re_{24}$	A+Re
93	92.7	"	$Hf_5Re_{24}+Re$	A
83.5	82.9	Homogeneous, trace 2nd phase	Hf_5Re_{24}	Hf_5Re_{24}
67.5	66.6	-ditto-	$HfRe_2$	$HfRe_2$
51.3	50.2	Heterogeneous	β-Hf+B	B+trace α-Hf
34.0	33.1	"	β-Hf+trace B	α-Hf+trace B

Table 2 gives the lattice constants of the two modifications of hafnium and $HfRe_{24}$ and $HfRe_2$

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APPROVED FOR RELEASE: 03/14/2001 CIA-RDP86-00513R001447410020-8"

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E032/E314

X-ray and Microscopic Study of Hf-Re Alloys

No. of alloy and heat treatmt.	Phase	Lattice constants A a	c	c/a
4. Annealed at 1000 °C	Hf_5Re_{24}	9.713±0.005	-	-
5. -do-	$HfRe_2$	5.248±0.001	8.592±0.002	1.637
6. -do-	α-Hf	3.20 ± 0.01	5.08 ± 0.01	1.58
7. Cast	β-Hf	3.50 ± 0.01	-	-

Table 4 gives the interatomic distances in $HfRe_{24}$:

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X-ray and Microscopic Study of Hf-Re Alloys

	Hf (a)	Hf (c)	Re (g_1)	Re (g_2)	Coordination No. (total)
Hf (a)	-	3.08 (4)	-	2.95 (12)	16
Hf (c)	3.08 (1)	-	2.71 (3) 3.21 (3)	2.93 (6) 3.15 (3)	16
Re (g_1)		2.71 (1) 3.21 (1)	2.91 (6)	2.67 (1) 2.73 (2) 2.90 (2)	13
Re (g_2)	2.95 (1)	2.93 (2) 3.15 (1)	2.67 (1) 2.73 (2) 2.90 (2)	2.44 (1) 2.61 (2)	12

X

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APPROVED FOR RELEASE: 03/14/2001 CIA-RDP86-00513R001447410020-8"

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E032/E314

X-ray and Microscopic Study of Hf-Re Alloys

The numbers in brackets in the above table refer to the coordination numbers. Table 6 gives the interatomic distances in $HfRe_2$.

	Hf	$Re^{(1)}$	$Re^{(2)}$	Coordination No. (total)
Hf	3.22 (3) 3.23 (1)	3.07_6 (3)	3.07_8 (3) 3.08_3 (6)	16
$Re^{(1)}$	3.07_6 (6)	-	2.62_8 (6)	12
$Re^{(2)}$	3.07_8 (2) 3.08_3 (4)	2.62_8 (2)	2.62_3 (4)	12

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87804

S/070/60/005/006/002/009
E032/E314

X-ray and Microscopic Study of Hf-Re Alloys

There are 6 tables and 9 references: 2 Soviet and 7 non-Soviet.

ASSOCIATION: L'vovskiy gosudarstvennyy universitet imeni I. Franko (L'vov State University imeni I. Franko)
Institut metallurgii imeni A.A. Baykova AN SSSR (Institute of Metallurgy imeni A.A. Baykov, AS USSR)

SUBMITTED: February 29, 1960 (initially)
June 2, 1960 (after revision)

Card 7/7

Savitskiy, Ye. M.

S/078/60/005/008/014/018
B004/B052

AUTHORS: Tylkina, M. A., Tsyganova, I. A., Savitskiy, Ye. M.

TITLE: Phase Diagram of the System Tantalum - Rhenium

PERIODICAL: Zhurnal neorganicheskoy khimii, 1960, Vol. 5, No. 8, pp. 1905-1907

TEXT: The phase diagram depicted in Fig. 1 was obtained by means of a determination of the fusing temperature, microscopic and radiographic analyses and measurement of the hardness of the structural components. The initial substances were tantalum foil (99.9% of Ta) and bricketed rhenium powder (99.8% of Re) at 1600°C. 18 alloys were produced in argon atmosphere in the arc furnace at 200 torr and remelted several times. The ground faces (Fig. 2) were etched with an aqueous solution of $NH_4F + HCl + HF + HNO_3$, and the microhardness of the components was determined. The X-ray pictures of pulverized alloys were taken by means of Cu-, Ni- and V-radiation. Two chemical compounds developed by peritectic reaction, a wide range of solid solutions on the tantalum side,

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Phase Diagram of the System Tantalum - Rhenium

S/078/60/005/008/014/018
B004/B052

and low solubility on the rhenium side were determined in the system. Structure, lattice constants, and ranges of χ- and σ-phases, and the two-phase range of $\sigma + \chi$ are described. There are 2 figures and 7 references: 4 Soviet, 1 US, 1 British, and 1 Polish.

ASSOCIATION: Institut metallurgii im. A. A. Baykova Akademii nauk SSSR (Institute of Metallurgy imeni A. A. Baykov of the Academy of Sciences USSR)

SUBMITTED: February 17, 1960

Card 2/2

SAVITSKIY, YE. M.

S/078/60/005/008/015/018
B004/B052

AUTHORS: Tylkina, M. A., Povarova, K. B., Savitskiy, Ye. M.

TITLE: Phase Diagram of the System Vanadium - Rhenium

PERIODICAL: Zhurnal neorganicheskoy khimii, 1960, Vol. 5, No. 8, pp. 1907-1910

TEXT: The phase diagram depicted in Fig. 1 was determined by means of a measurement of the melting temperatures, microscopic and radiographic analyses, measurement of the hardness of the alloys and the micro hardness of the components. The initial substances were V and Re powder fused together in an arc furnace. The melting temperature was determined by means of an optical pyrometer calibrated according to the pure metals. The hardness was measured according to Vickers with a ПМТ-3 (PMT-3) apparatus. The X-ray pictures were taken with an РКД (RKD) camera. In Fig. 2 the microstructures of V-Re alloys are depicted, and a Table gives the analytical data and hardnesses. An exact description of ranges, lattice constants, and physical data of the new σ-phase (VRe_3)

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Phase Diagram of the System Vanadium - Rhenium

S/078/60/005/008/015/018
B004/B052

which is only stable above 1500°C are given, and also the ranges of the solid solutions, α- and β-phases, $\alpha+\beta$ eutectic, and the twophase ranges of $\alpha+\sigma$ and $\sigma+\beta$. There are 2 figures, 1 table, and 2 references: 1 Soviet and 1 US.

ASSOCIATION: Institut metallurgii im. A. A. Baykova Akademii nauk SSSR (Institute of Metallurgy imeni A. A. Baykov of the Academy of Sciences, USSR)

SUBMITTED: February 17, 1960

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88595

S/078/60/005/011/005/025
B015/B060

18.1275

AUTHORS: Savitskiy, Ye. M., Kopetskiy, Ch. V.

TITLE: Constitution Diagrams of Systems of Manganese With Titanium and Zirconium

PERIODICAL: Zhurnal neorganicheskoy khimii, 1960, Vol. 5, No. 11, pp. 2422-2434

TEXT: The constitution diagram for manganese-zirconium (up to 30 wt% Zr) and for manganese-titanium (up to 30 wt% Ti) was set up by the methods of microstructural phase analysis, X-ray phase analysis, thermal analysis, and measurement of hardness and microhardness. The alloys were prepared by repeated remelting in a vacuum high-frequency furnace of the type МВП-4 (MVP-4) with generator of the type ЛГП-30 (LGP-30). The alloys (Table 1, composition) were examined both in the cast and in the annealed state. A ТП (TP) apparatus served for the hardness determination, a ПМТ-3 (PMT-3) apparatus for the microhardness, an РКД (RKD) camera served for the X-ray phase analysis of the powder

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Constitution Diagrams of Systems of Manganese With Titanium and Zirconium

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B015/B060

samples, and, finally, Kurnakov's pyrometer and a device worked out by I. I. Tyurin (Fig. 1) served for the differential thermal analysis. The pictures of microstructure (Fig. 2), of the Mn-Zr alloy show that already at a content of 4.5 wt% Zr a second phase is formed, identified as $ZrMn_2$ compound by the X-ray analysis (Table 2, data of X-ray analysis) and having the following lattice parameters: a = 5.029 kX, c = 8.234 kX, c/a = 1.637. The X-ray pictures show furthermore that in cast specimens, Mn always occurs in the β-modification, whereas only α-Mn is observed with annealed specimens. The results of X-ray phase analysis (Table 3) further show that the $ZrMn_2$ compound apparently exhibits no region of homogeneity. Data obtained from the investigation of hardness and microhardness of Mn-Zr alloys (Table 4) are in good agreement with results yielded by other methods. Microstructural examinations of the Mn-Ti system (Fig. 4, pictures) as well as the X-ray structural pictures indicate the existence of two intermetallic compounds in the concentration range from 0 to 30 wt% Ti. One is $TiMn_2$ and has a hexagonal lattice with a = 4.812 kX, c = 7.817 kX, c/a = 1.624 (Table 5, data obtained from the X-ray picture of $TiMn_2$). The second compound, which exists at

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concentrations from 6.55 to 22.5 wt% Ti, probably has the formula $TiMn_4$ and results from a peritectic reaction at 1230°C (Table 6, data obtained from the powder X-ray picture of the new compound). Results yielded by the phase X-ray analysis of the system Mn-Ti are given in Table 7, the values from hardness tests in Table 8, values relating to microhardness in Fig. 6, and the constitution diagram in Fig. 8. Table 9 shows the results of hardness- and microhardness tests for the Mn-Zr system, and Fig. 7 shows the respective constitution diagram. Additions of zirconium and titanium to manganese have little effect on the $\alpha \rightleftarrows \beta$ transition, which takes place at 730°C in both cases. In the Mn-Zr system, the $\beta \rightleftarrows \gamma$ transition runs according to a peritectoid reaction at 1125°C, and the same holds for the Mn-Ti system at 1160°C. In both systems the alloys are hardened according to a eutectic reaction, and, more precisely, at 1160°C for the Mn-Zr system and at 1195°C for Mn-Ti. The $\gamma \rightleftarrows \delta$ transition takes place at 1225°C for both systems according to a peritectic reaction. Hardness tests showed that the intermetallic compounds $ZrMn_2$, $TiMn_2$, and $TiMn_4$ have a considerably lower hardness degree than α- or β-Mn. There

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Constitution Diagrams of Systems of Manganese With Titanium and Zirconium

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are 8 figures, 9 tables, and 10 references: 1 Soviet and 5 US.

ASSOCIATION: Institut metallurgii im. A. A. Baykova Akademii nauk SSSR (Institute of Metallurgy imeni A. A. Baykov of the Academy of Sciences USSR)

SUBMITTED: August 19, 1959

Card 4/4

88598

S/078/60/005/011/009/025
B015/B060

18.1200

AUTHORS: Tylkina, M. A., Povarova, K. B., Savitskiy, Ye. M.

TITLE: Ternary Solid Solutions in the Tungsten - Molybdenum - Rhenium System

PERIODICAL: Zhurnal neorganicheskoy khimii, 1960, Vol. 5, No. 11, pp. 2458-2461

TEXT: The article under consideration shows a part of the constitution diagram of the W - Mo - Re ternary system obtained by the method of microstructural analysis, by measuring the hardness and the melting point of the alloys. The authors studied the diagram on the side of the solid solution in tungsten and molybdenum up to 50 wt% rhenium, with the alloys of the parallel cross sections W - Mo being selected with a constant rhenium content of 10, 20, 30, 40, and 50% (Fig. 1). From the data of phase analysis, three isothermal cross sections of cast alloys, annealed at 1750°C for 3 h, and at 1000°C for 450 h were recorded. The cuts for the microstructural examinations were etched in a mixture of 10% KOH and 30% $K_3[Fe(CN)_6]$ (1 : 2). A fairly large region of ternary solid solutions

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with body-centered cubic crystal lattice was observed in the system concerned. A ternary σ-phase formed. Between the ternary solid α-solutions and the σ-phase there is the two-phase region $\alpha+\sigma$ (Fig. 1). It may be observed from the pictures of microstructure (Fig. 2) of the cross section with 40 wt% Re that the alloy with 40 wt% W and 20 wt% Mo is situated at the limit of solubility and is a one-phase ternary solid solution at high temperatures, which on a decrease of temperature passes over into the two-phase state $\alpha+\sigma$. The alloy with 30 wt% W and 30 wt% Mo remains a one-phase ternary solid solution at all temperatures. The alloy 50 wt% W and 10 wt% Mo, on the other hand, has a two-phase structure $\alpha+\sigma$ at all temperatures. The formation of twins, which had already been observed by Highes and Geach (Ref. 5), C.T. Sims and R. J. Jaffee (Ref. 6) was identified in the region of ternary solid solutions. This additional deformation by twinning is explained by the larger amount (in this field) of the densely packed hexagonal rhenium. For this reason, high elasticity and good mechanical properties are expected of alloys of this region. In the region of ternary solid solutions hardness changes little with temperature (Table). Changes in the solidus temperature showed that in the region of ternary solid solutions at constant rhenium content (up to

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30 wt% Re) there occurs a uniform drop of the melting point of alloys with a decrease of the tungsten content and an increase of the molybdenum content. In the authors' opinion, the alloys of the composition of ternary solid solutions are specially suited as building material, wherever great demands are made on strength, plasticity, weldability, and a high melting point, but no stability to oxidation at high temperatures. There are 2 figures, 1 table, and 8 references: 4 Soviet, 3 German, and 1 US.

ASSOCIATION: Institut metallurgii im. A. A. Baykova Akademii nauk SSSR (Institute of Metallurgy imeni A. A. Baykov of the Academy of Sciences of the USSR)

SUBMITTED: February 17, 1960

Card 3/3

S/078/60/005/011/017/025
B015/B060

AUTHORS: Savitskiy, Ye. M., Kopetskiy, Ch. V.

TITLE: Constitution Diagram of the Manganese - Tantalum System

PERIODICAL: Zhurnal neorganicheskoy khimii, 1960, Vol. 5, No. 11, pp. 2638 - 2640

TEXT: The Mn - Ta system was studied up to 24.68 at% Ta by the methods of microstructural and X-ray structural phase analysis, thermal analysis, as well as the microhardness method. The alloys were melted in a high-frequency vacuum furnace of the type МВП-4 (MVP-4) and alloys with 0.93, 1.0, 2.86, 3.64, 6.0, 8.0, 12.22, 27.58, and 51.90 wt% of tantalum were prepared. The alloys were very brittle, especially those containing 6-12% Ta. The microstructural analysis (Fig. 1) showed that alloys with 0.93 and 1.0 wt% Ta constitute a solid solution on the basis of manganese. In the alloy with 2.86 wt% Ta a second phase, which increases with increasing tantalum content, begins separating. It separates in a form which is characteristic of a eutectic reaction of the components. In alloys with 8.0 wt% Ta and over, coarse, overeutectic separations of an intermetallic

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Constitution Diagram of the Manganese - Tantalum System

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compound were observed. X-ray analysis confirmed the last-mentioned results and it was noted that the new phase was Mn_2Ta with a crystal lattice a = 4.842 kX, c = 7.895 kX, c/a = 1.630. Thermal analysis of the alloys was carried out with an apparatus described in Ref. 3, using tungsten/rhenium thermoelements of the type BP 5/20 (VR 5/20). Additions of tantalum to manganese cause a reduction of the melting point of the alloys down to the eutectic horizontal running at 1175°C. Tantalum has little effect on the temperature of the $\alpha \rightleftarrows \beta$ transformation taking place at 750°C. The microhardness was measured by a ПМТ-3 (PMT-3) instrument, and the microhardness of the compound Mn_2Ta with 730 kg/mm^2 was found to be considerably lower than that of the solid solution on the basis of α-Mn (1100 - 1180 kg/mm^2). The Mn - Ta constitution diagram was constructed on the strength of results obtained (Fig. 2). There are 2 figures and 4 references: 2 Soviet, 1 German, and 1 US.

SUBMITTED: May 18, 1960

Card 2/2

82282

S/089/60/009/01/05/011
B014/B070

18.8200

AUTHORS: Dashkovskiy, A. I., Yevstyukhin, A. I., Savitskiy, Ye. M., Skorov, D. M.

TITLE: Internal Friction of Uranium

PERIODICAL: Atomnaya energiya, 1960, Vol. 9, No. 1, pp. 27 - 32

TEXT: The internal friction and, thus, the modulus of rigidity of uranium as dependent on temperature was measured by means of a relaxator which recorded the damping of the free torsional oscillations of a sample. A uranium wire of a length of 320 mm (diameter 0.98 mm) and a purity of 99.9% was used as a sample. The frequency of oscillations of the wire in a vacuum of $5 \cdot 10^{-5}$ torr was ~ 2/sec. The rate of heating or cooling varied in the range 5 - 0.5°C/min. The accuracy of temperature measurement was ± 1.5°C. According to the three phases of uranium, the samples were annealed at 630, 645, 670, 720, 755, 768, 850, and 960°C. The course of the measured parameters is represented for the various temperatures in Figs. 1-5. The results of measurement lead to the

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Internal Friction of Uranium S/089/60/009/01/05/011
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following conclusions: (1) The bend in the internal friction curve in the temperature range 450 - 500°C is caused by the tenacity of the grain boundaries. This tenacity disappears after annealing in the β- and γ-phases. This is the result of the recrystallization of phases due to lower mobility of the boundaries. (2) In temperature changes, the polymorphous transformations of uranium are accompanied by an isothermal change in internal friction. The changes take place during heating as well as during cooling in both directions. (3) The most plastic γ-domain, which has a body-centered cubic lattice, is characterized by a high internal friction. The tetragonal β-modification which tends to brittleness, has the lowest internal friction. It is generally true that the internal friction is related directly to the crystal lattice and to its capability of plastic deformation. There are 5 figures and 13 references: 10 Soviet, 2 American, and 1 French. 4

SUBMITTED: October 3, 1959

Card 2/2

SAVITSKIY, Ye.M.; DUYSEMALIYEV, U.K.

Effect of vanadium on the properties of commercial alloys with a nickel base. Vest.AN Kazakh.SSR 16 no.6:43-47 Je '60. (MIRA 13:7)
(Nickel alloys) (Vanadium)

SAVITSKIY, Ye.M., prof.

Rare earth metals and prospects for their use in industry. Vest.AN SSSR 30 no.6:81-88 Je '60. (MIRA 13:6)
(Rare earth metals)

APPROVED FOR RELEASE: 03/14/2001 CIA-RDP86-00513R001447410020-8"

SAVITSKIY, Ye.M., prof.

At the congress of the American Electrochemical Society. Vest.AN SSSR 30 no.9:75-77 S '60. (MIRA 13:9)
(Electrometallurgy--Congresses)

SAVITSKIY, Ye.M.; TEREKHOVA, V.F.; NAUMKIN, O.P.

Erbium and its alloys. TSvet.met. 33 no.1:43-48 Ja '60. (MIRA 13:5)

(Erbium)

SAVITSKIY, Ye.M.; VLASOV, A.I.

Sintered copper powder. TSvet. met. 33 no.7:72-77 Jl '60. (MIRA 13:7)

1. Vsesoyuznyy nauchno-issledovatel'skiy institut tverdykh splavov. (Powder metallurgy) (Copper)

SAVITSKIY, Ye.M.; TEREKHOVA, V.F.; BUROV, I.V.

Gadolinium and its alloys. TSvet. met. 33 no.11:59-64 N '60.
(MIRA 13:11)

(Gadolinium)

68992
S/020/60/131/02/034/071
B011/B005

18 9200

AUTHORS: Tylkina, M. A., Povarova, K. B., Savitskiy, Ye. M.

TITLE: The Sigma Phase in the Rhenium-Vanadium System

PERIODICAL: Doklady Akademii nauk SSSR, 1960, Vol 131, Nr 2, pp 332-334 (USSR)

ABSTRACT: In their previous paper, the authors established the phase diagram of the vanadium-rhenium system (Ref 10). In the present paper, they wanted to determine the temperature range of the existence of the σ-phase. For this purpose, they annealed casting alloys at high temperature (1750° for 7 h, 1500° for 5 h, 1000° for 450 h). The X-ray investigation was carried out in a chamber of type PKD with CrKα-radiation. The X-ray structural and microstructural investigations showed the eutectoid decomposition of the σ-phase at 1500°. 2 solid solutions are formed: on the basis of vanadium (α) and rhenium (Fig 1 a,b). The roentgenogram of a casting alloy shows a system of lines characteristic of σ-phases (Table 1). The lattice parameters were computed as follows: a = 9.39 Å, c = 4.86 Å, c/a = 0.52. Table 1 lists comparative data of roentgenographic calculations of σ-phases in rhenium systems with zirconium, vanadium, niobium, tantalum, chromium, molybdenum, wolfram, manganese, and iron (Refs 4-9). A certain phase difference in the system

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The Sigma Phase in the Rhenium-Vanadium System

Zr-Re is striking; the authors assigned this phase to a type related to the σ-phases. This difference may be explained by the fact that the metals of the 4th side group usually do not form σ-phases. The appearance of the σ-phase in the system Zr-Re might be considered to be an exception. Moreover, the formation of σ-phases in the rhenium system with manganese and iron (Ref 8) is worth noticing. This suggests an anomalous behavior of rhenium as compared with metals of other groups. There are 1 figure, 1 table, and 10 references, 8 of which are Soviet.

ASSOCIATION: Institut metallurgii im. A. A. Baykova Akademii nauk SSSR (Institute of Metallurgy imeni A. A. Baykov of the Academy of Sciences, USSR)

PRESENTED: December 2, 1959, by I. P. Bardin, Academician

SUBMITTED: December 1, 1959

S/020/60/131/04/027/073
B013/B007

AUTHORS: Savitskiy, Ye. M., Duysemaliyev, U. K.

TITLE: Superplasticity of LS59-1 Brass Which Is Alloyed With Cerium

PERIODICAL: Doklady Akademii nauk SSSR, 1960, Vol 131, Nr 4, pp 817-819 (USSR)

TEXT: The authors discovered the superplasticity of LS59-1 brass when testing the mechanical properties of cerium-alloyed brass at various temperatures. MO electrolytic copper, TsV zinc, and S-1 lead were used for fusion. Cerium was added in the form of a mixed crystal consisting of the following components (in wt%): La 21; Ce 51.4; Fe 0.84; Zn 0.003; Cl 0.006; S 0.005; P 0.0006. The specimens were produced in a high-frequency induction furnace of the type Ayaks. Table 1 lists the chemical composition of LS59-1 test melts. From the castings made in this manner specimens were turned out for breaking tests in the cast and the deformed, annealed state, after which they were subjected to tensile tests under static load. The test temperature was measured by means of a chromel-aluminum thermocouple. Three specimens were tested at each individual temperature. The relative elongation δ (in per cent) served as a measure of plasticity since this property illustrates superplasticity more clearly than the narrowing. Microstructural analyses showed that these alloys have two phases. Table 1 further contains data concerning the elongation of the specimens. The

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B013/B007

Superplasticity of LS59-1 Brass Which Is Alloyed With Cerium

elongation δ of LS59-1 brass containing various admixtures of mixed metals (in the cast and the deformed, annealed state) has a peak in the range of between 700° and 750°. The plasticity of diphase brass is improved in all cases by adding mixed metal admixtures without any change in its lead content. The temperature dependence of elongation found in a tensile test of the brass specimen is fundamentally changed by adding about 0.1 per cent of Ce. The zone of brittleness is smoothed, and the relative elongation δ at the temperature of maximum plasticity (750°) exceeds 150 per cent in the deformed, annealed state. The authors did not determine the optimum Ce content of LS59-1 brass, but they arrived at the following conclusions: An addition of about 0.1 per cent of Ce promotes the occurrence of superplasticity, but a Ce content of 0.5 per cent diminishes this effect. Nor did they determine the physico-chemical causes of superplasticity. However, it was found that the intensity of this effect depends considerably on the heating rate and the time for which the specimen is subject to a temperature of from 740-750°. In this temperature range LS59-1 brass undergoes the phase transformation $(\alpha + \beta) \rightleftarrows \beta$. Superplasticity is in some relation to the metastable state of cerium-alloyed LS59-1 brass. This is the reason why superplasticity is reduced by the action of heat that approaches the alloy toward the state of equilibrium. Mention is made of A. A. Bochvar,

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Superplasticity of LS59-1 Brass Which Is Alloyed With Cerium

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Z. A. Sviderskaya, A. A. Presnyakov, V. V. Chervyakov, and G. V. Starikova.
There are 3 figures, 1 table, and 3 Soviet references.

PRESENTED: Ocotber 19, 1959, by I. P. Bardin, Academician

SUBMITTED: October 13, 1959

Card 3/3

18.8200
8.9200

80009
S/020/60/131/05/043/069
B011/B117

AUTHORS: Savitskiy, Ye. M., Kopetskiy, Ch. V.

TITLE: On the Question Regarding the Plasticity of High-temperature Modifications of Polymorphous Metals

PERIODICAL: Doklady Akademii nauk SSSR, 1960, Vol 131, Nr 5, pp 1137-1139 (USSR)

TEXT: It is stated by the authors that the rule established by Ye. M. Savitskiy with respect to the plasticity of high-temperature modifications of polymorphous metals is of great importance for physics. It obviously points to the close relationship between polymorphism and electron-structural change in the atoms of polymorphic metals with temperature. According to the mentioned rule, the highest-temperature modification of a polymorphous metal must show the highest plasticity. It must have a crystalline structure of the cubic type promoting plastic deformation, i. e. predominantly a face-centered one. From the mentioned rule, some theoretically and practically important conclusions were drawn. It has been also repeatedly confirmed (Refs 2,3). In table 1, polymorphous metals together with their crystalline structures and the temperatures of transition from one modification to another are shown. Table 1 illustrates the Savitskiy rule (tin being an exception). The rule can be obviously explained by the fact that the simpler symmetrical crystalline structures are more stable in all high-

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80009

On the Question Regarding the Plasticity of High-temperature Modifications of Polymorphous Metals

S/020/60/131/05/043/069
B011/B117

temperature phase transitions. That is because they have a lower free energy and a higher entropy. It can be presumed that the polymorphous modifications of the matter are formed as the result of electron-structural changes in the bound atoms and in consequence of the corresponding qualitative changes in the inter-atomic bonds with temperature (Ref 4). The portion of metallic bonds is apparently increased by higher temperatures. There is evidently a relationship between the electron state of the bound metal atoms, the number of electrons per atom, or the electron concentration and temperature changes. The individual polymorphous modifications correspond to different electron states and to a different electron concentration. The authors make reference to the zone theory of metals involving packing of zones, by Brillouin, and to the theories by H. Jones (Ref 5) and Yum-Rozeri (Refs 6 - 9). From table 1, it is evident that with polymorphous metals except calcium, strontium, and tin polymorphous transitions at temperature decreases take place in a way to maintain a certain sequence of crystal-structural changes: K12(K8)⟶G12 (the more complicated one). At a temperature decrease, a closely packed hexagonal structure instead of a face-centered or a body-centered cubic structure forms (with several exceptions). From this, the authors conclude that in the crystalline structure of the polymorphous modifications (except calcium and strontium) a successive increase in the limit

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80009
S/020/60/131/05/043/069
B011/B117

On the Question Regarding the Plasticity of High-temperature Modifications of Polymorphous Metals

electron concentration takes place. Crystalline structures with higher limit electron concentrations are more stable at lower temperatures, while the high-temperature modifications have a lower limit electron concentration. The authors assume that a polymorphous substance passes a successive series of states when temperature is decreased each of which is characterized by a defined electron concentration. This concentration steadily increases with the temperature decrease; it also produces a successive change in crystal structures. The authors also come to the conclusion that the number of free electrons in an atom of polymorphous metals increases with decreasing temperature. With iron, manganese, plutonium, and thorium, the mentioned sequence is not observed. There are 1 table and 9 references, 7 of which are Soviet.

ASSOCIATION: Institut metallurgii im. A. A. Baykova Akademii nauk SSSR (Institute of Metallurgy imeni A. A. Baykov of the Academy of Sciences, USSR)

PRESENTED: December 10, 1959, by I. P. Bardin, Academician

SUBMITTED: December 1, 1959

Card 3/3

SAVITSKIY, Ye.M., doktor khim. nauk, otv. red.; RYABCHIKOV, D.I., doktor khim. nauk, red.; BIBIKOVA, V.I., doktor khim. nauk, red.; TYLKINA, M.A., kand. tekhn. nauk, red.; POVAROVA, K.B., inzh., red.; MAKARENKO, M.G., red. izd-va; SIMKINA, G.S., tekhn. red.

[Rhenium; transactions] Renii; trudy. Moskva, Izd-vo Akad. nauk SSSR, 1961. 278 p. (MIRA 15:1)

1. Vsesoyuznoye soveshchaniye po probleme reniya, 1958. (Rhenium)

ZAKHAROVA, Galina Vasil'yevna, kand. tekhn. nauk; POPOV, Ivan Alekseyevich, kand. tekhn. nauk; ZHOROVA, Liliana Pavlovna; FEDIN, Boris Vladimirovich; Prinimali uchastiye: MUKHINA, Z.S., zasl. deyatel' nauki i tekhn. RSFSR; POPOVA, I.A., zasl. deyatel' nauki i tekhn. RSFSR; YEGOROVA, N.D., zasl. deyatel' nauki i tekhn.RSFSR; NIKITINA, Ye.I., zasl. deyatel' nauki i tekhn. RSFSR; ZHEMCHUZHNAYA, Ye.A., zasl. deyatel' nauki i tekhn. RSFSR; ZHABINA, V.A.; SAVITSKIY, Ye.M., red.; STROYEV, A.S., red.; ARKHANGEL'SKAYA, M.S., red. izd-va; KARASEV, A.I., tekhn. red.

[Niobium and its alloys] Niobii i ego splavy. By G.V.Zakharova i dr. Moskva, Gos. nauchno-tekhn. izd-vo lit-ry po chernoi i tsvetnoi metallurgii, 1961. 368 p. (MIRA 14:12)
(Niobium)

S/762/61/000/000/006/029

AUTHORS: Savitskiy, Ye.M., Livanov, V.A., Nuss, P.A., Burkhanov, K.S., Musatov, M.I., Simanchuk, A.D.

TITLE: Alloys of titanium with rare-earth metals.

SOURCE: Titan v promyshlennosti; sbornik statey. Ed. by S.G. Glazunov. Moscow, 1961, 85-89.

TEXT: The paper reports the results of phase-diagram (PD) determinations and mechanical tests (beginning in 1959) at the Institute of Metallurgy, AS USSR, of Ti alloys with the rare-earth metals (REM) lanthanum (La), cerium (Ce), neodymium (Nd), and Yttrium (Y), all of which serve as stabilizers of the Ti α phase. The alloys are all characterized by a peritectoid-type PD. In the Ti corner of ternary Ti-Al-La and Ti-Al-Ce it was shown that increased Al content reduced the solubility of La and Ce (at 600°C, with 5% Al, Ce solubility < 0.1%). Tests on the effect of REM additions on the high-temperature characteristics (HTC) of Ti alloys were performed on the two-phase α+β alloy BT3-1 (VT3-1) and the BT5-1 (VT5-1) single-phase α-Ti solid solution (SS). The effect of Ce, Mischmetal (MM), and Ce_2O_3 on VT3-1 were determined with 0.001, 0.01, and 0.1% Ce; 0.2% MM, and 0.01 and 0.1% Ce_2O_3. The effect of 0.1% Ce alone was determined on VT5-1. Ce and MM were introduced in the form of Al-Ce and Al-MM ligatures. Microadditions (0.001-0.01%) of Ce increased the tensile strength of Ti alloys at 500-600° by 25-30% with-

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35086
S/697/61/000/000/012/018
D228/D303

18.1200

AUTHORS: Tylkina, M. A. and Savitskiy, Ye. M.

TITLE: The physico-chemical properties and the sphere of application of rhenium and its alloys

SOURCE: Akademiya nauk SSSR. Institut metallurgii im. A. A. Baykova. Institut mineralogii, geokhimii i kristallokhimii redkikh elementov. Mezhduvedomstvennaya komissiya po redkim metallam. Vsesoyuznoye soveshchaniye po probleme reniya. Moscow, 1958. Reniy; trudy soveshchaniya. Moscow, Izd-vo AN SSSR, 1961, 108-126

TEXT: The authors consider their own data and those of other scientists on the physico-chemical properties and uses of Re and its alloys. Previous work by Ye. M. Savitskiy, M. A. Tylkina, and K. B. Povarova (Ref. 9: Dokl. AN SSSR, 119, no. 2, 1958, 274), who studied the structural diagrams of Re and its reaction with other elements, is specially noted in this respect. Having compared the physico-chemical properties of Re, W and Mo, the authors cite data

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D228/D303

The physico-chemical properties ...

to illustrate the changes in the elasticity modulus and yield strength of Re in relation to the temperature; the rate of oxidation of Re; the tension and pressure of Re vapor between 2494 and 5900°K; the influence of the degree of deformation on the mechanical properties of Re; the recrystallization of cast cold-deformed RE; and the hardness of this type of metal after annealing at 1000 - 2400°C. The microstructure of cast metal and of deformed, annealed metal is also discussed. As regards the influence of Re on the recrystallization of metals, graphs show how Ni, Ni-Cr, Ti and W are affected by Re at temperatures from 500 to 1500°C. Factual material is presented about the influence of temperature changes on the mechanical properties of Re, the yield strength of Re and other metals, and the long-term stability of Re, W, Mo and Nb. Then the authors list the various uses of Re and its alloys: 1) as an alloying element to raise the heat stability of metals; 2) in the electrovacuum industry; 3) in thermocouples; 4) as material for electrocontacts; 5) as an emitter; 6) as wear-resisting material; 7) for springs acting at high temperatures; 8) as an alloying ingredient to increase the plasticity of W and Mo; 9) for intensify-

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S/697/61/000/000/012/018
D228/D303

The physico-chemical properties ...

ing combustion in engines; 10) as galvanic coatings; 11) as catalysts. The uses of Re in 1), 2), and 4) are illustrated by means of graphs. These depict, among other things, the effect of Re additions on the strength and plasticity of W wire; the influence of the annealing temperature on the strength of W-Re wire under tension; and the effect of heat changes on the electro-resistance of similar material. There are 17 figures, 6 tables and 25 references: 14 Soviet-bloc and 11 non-Soviet-bloc. The 4 most recent references to the English-language publications read as follows: E. M. Sherwood et al., J. Electrochem. Soc., 102, no. 11, 650-654 (1955); C. T. Sims et al., J. Metals, sec. 2, 8 (8), 913-917 (1956) and Rev. Scient. Instrum., 30, no. 2, 112-115 (1959); J. M. Pugh, J. Metals, 10 (5), 335-340 (1958).

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20263

S/129/61/000/003/010/011
E073/E335

18.1250

AUTHORS: Savitskiy, Ye.M., Doctor of Chemical Sciences, Professor, Duysemaliyev, U.K., Engineer

TITLE: Mechanical Properties of Copper-vanadium and Nickel-vanadium Alloys at Elevated Temperatures

PERIODICAL: Metallovedeniye i termicheskaya obrabotka metallov, 1961, No. 3, pp. 52 - 55

TEXT: The authors studied the mechanical properties at room and at elevated temperatures of copper- abd nickel-base alloys with admixtures of vanadium. The alloys were smelted in a high-frequency induction furnace in corundum crucibles inside an argon stream. From these, 300-g ingots were produced, which were forged to 10 x 10 mm cross-section. These were then annealed in evacuated quartz ampules. Alloys of the system Cu-V were annealed at 900 °C for 50-100 hours and alloys of the system Ni-V were annealed at 1 000 °C for 100 hours. The vanadium contents of the Cu-base alloys were 0.07, 0.34, 0.64, 2.25 and 3.29% and the nickel-base alloys contained 0.5, 1, 3, 5, 6 and 10%. The microstructure, hardness at room temperature,

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20263

S/129/61/000/003/010/011
E073/E335

Mechanical Properties ....

ductility and tensile strength were determined for deformed and for annealed specimens. The mechanical tests were carried out at 20, 100, 300, 500 and 700 °C. Specimens were preliminarily heated in an electric furnace to the required temperature and held at that temperature for 20 min. Microstructure investigations of alloys after homogenisation annealing indicate that specimens contained up to 0.07% V for a single phase, whilst the others are two-phase alloys. The temperature dependence of the mechanical properties of Cu-V alloys is plotted in Fig. 1 - upper graph: relative contraction, ψ, % - lower graph: ultimate strength, σ_B, kg/mm^2. Vanadium increases the hardness whereby the highest hardness, 59 kg/mm^2, was obtained for a vanadium content in excess of 3%. Thus, additions of vanadium increase the hardness, strength and ductility of copper and reduce its tensile strength temperature coefficient. V-Ni alloys were investigated by Pearson and Hume-Rothery (Ref. 4). The authors of this paper investigated Ni-V alloys with V contents up to [illegible] mechanical properties of such alloys

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S/129/61/000/003/010/011
E073/E335

Mechanical Properties ....

at various temperatures are entered in Table 3 for V contents of 0-10%. Data are also given on the temperature coefficient of the strength of Ni and its alloys between 20 and 700 °C. V additions bring about an increase in hardness, strength and ductility and a decrease in the temperature coefficient of the tensile strength. The following conclusions are arrived at: 1) Vanadium is a useful deoxidation and alloying addition to Cu and Ni. Small additions (up to 0.4 in Cu and up to 1% in Ni) bring about an increase in the mechanical strength and a decrease in the temperature coefficient in the case of static tension.
2) Introduction of V into Cu eliminates the brittleness at 500 °C.
There are 2 figures, 4 tables and 4 references: 1 Soviet and 3 non-Soviet.

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S/129/61/000/003/010/011
E073/E335

Mechanical Properties ....

ASSOCIATIONS: Institut metallurgii AN SSSR (Institute of Metallurgy of the AS USSR)
Institut yadernoy fiziki AN Kazakhskoy SSR (Institute of Nuclear Physics of the AS Kazakh SSR)

X

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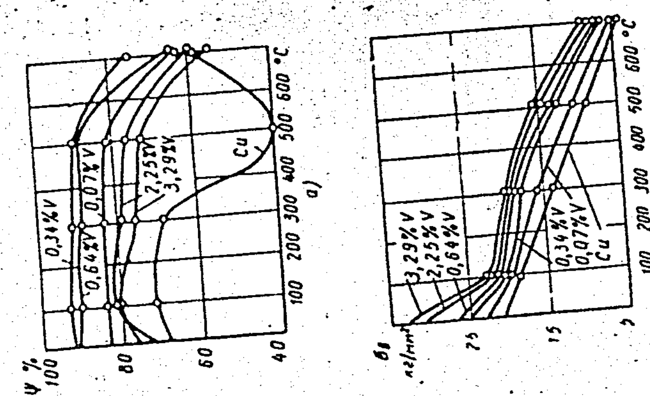
20263

S/129/61/000/003/010/011
E073/E335

Mechanical Properties ....

Fig. 1:



Фиг. 1. Температурная зависимость механических свойств медlivanadиевых сплавов: а — относительное сужение; б — предел прочности.

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S/129/61/000/003/010/011
E073/E335

Mechanical Properties ....

Table 3:

Таблица 3

Механические свойства никелеванадиевых сплавов при различных температурах

(V content, %) Содержание ванадия в %	20°			100°		300°		500°		700°	
	HB в кг/мм²	σ_b в кг/мм²	ψ в %	σ_b в кг/мм²	ψ в %	σ_b в кг/мм²	ψ в %	σ_b в кг/мм²	ψ в %	σ_b в кг/мм²	ψ в %
(Nickel) Никель	58	45	59,0	43	60,5	21,0	62,5	18	38	7	70,0
0,5	61	50	59,5	47	61,0	24,0	56,0	19	67	8	72,0
1,0	62	52	64,0	49	74,0	25,5	52,5	21	65	10	75,0
3,0	68	53	58,0	50	72,5	28,0	59,0	23	61	11	64,0
5,0	72	55	48,0	52	72,0	32,0	60,0	24	40	12	58,0
7,0	78	57	45,0	54	50,0	38,0	57,5	27	41	14	57,5
10,0	84	58	45,0	55	47,5	40,0	49,0	31	42	15	27,5

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S/755/61/000/003/020/027

AUTHORS: Dashkovskiy, A. I., Savitskiy, Ye. M.

TITLE: The temperature dependence of the internal friction, shear modulus, and linear expansion of lanthanum and cerium.

SOURCE: Moscow. Inzhenerno-fizicheskiy institut. Metallurgiya i metallovedeniye chistykh metallov. no.3. 1961, 196-202.

TEXT: The paper describes measurements of the T dependence of the internal friction (IF) and the shear modulus (G) of La and Ce up to 600-670°C and the value of the G at room T. Dilatometric investigation of these metals is performed up to 700-730°C. The La specimens tested contained 0.8% Nd, 1% Pr, and less than $3 \cdot 10^{-4}$% Pb, Cd, and Bi. The Ce contained 0.75% Nd, 0.75% Pr, 0.01% Fe, and less than $1 \cdot 10^{-4}$% Pb. The specimens were prepared by extrusion on a universal equipment (cf. Savitskiy, Ye. M., Zavodsk. laboratoriya, v.16, no.11, 1950) at T 350-400°C in an atmosphere of Ar. O content in the specimens was less than 0.01%. Even and smooth rods 3.5-mm diam and up to 300 mm long were prepared. Following anneal, the measurements were performed on the equipment described by the authors et al. in no.2 of this sbornik, Atomizdat, 1960, 207. Max. shear deformation at the specimen surface: 10^{-5}; the strain due to the tensile load applied by the weight of the oscillatory system is less than 10^{-5}. Test frequency: 4.5 cps. Rate of heating and

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S/755/61/000/003/020/027

The temperature dependence of the internal ...

cooling: 2.5°C/min. Dilatometric measurements were performed in a quartz vacuum dilatometer with a pointer-type indicator (0.001-mm value of one division) at a heating and cooling rate of 3.5°C/min. In the IF curve of La with heating an almost linear increase is observed to 150°C, then a sharper increase to a peak at 340°C, a sharp drop to about 370°, and a further steep rise. On cooling, the same curve is nearly reproduced, but with the sharp intermediate peak at about 325°. This peaking, together with a coincident noticeable change in G and in the specimen volume is undoubtedly attributable to an allotropic $\alpha \rightleftarrows \beta$ transformation. In Ce the IF curve for heating of 1-hr 600°-annealed Ce is appx. linear to 250°C, then a steeper rise, a flat spot in the 350-450° region, and an increasingly steep rise beyond 500°. The cooling curve reproduces the heating curve, but remains slightly higher. Ce annealed for 20 min at 500°C exhibits a pronounced maximum at 380°C. This phenomenon is attributed to viscous grain-boundary behavior, which is minimized by the grain-size growth incident to high-T or long-time anneal. The G curve of Ce is appx. linear to 400°, whereupon G relaxation sets in, attributable to grain-boundary viscosity. At room T, the G of La was found to be 1,480 ± 50 kg/mm², that of Ce 1,350 ± 50 kg/mm². La expands about linearly to 325°C, at a rate of about $5.45 \cdot 10^{-6}$. From 325 to 375° the $\alpha - \beta$-La transformation results in a volumetric contraction of 0.218%. The further dilation of the β-La is linear, at a rate of $9.56 \cdot 10^{-6}$, until at 700°C excessive plasticity interferes with the experiment. Upon cooling, the $\beta - \alpha$ transformation is encountered in the 300-250°C T interval (lower with

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APPROVED FOR RELEASE: 03/14/2001 CIA-RDP86-00513R001447410020-8"

S/755/61/000/003/020/027

The temperature dependence of the internal ...

greater cooling rates). Ce dilates linearly up to 650°C at a rate of $9.75 \cdot 10^{-6}$, attains a plateau from 650-700°, and shrinks by 0.453% from 700-720°C. The hysteresis observed during cooling leads to a minimum at about 600°, a peak near 550°, and linear contraction below 550°. These figures concur fundamentally with extant literature data (cf., e. g., Trombe, F., Fox, M., C. R. Acad. sci., v.217, 1943, 501). It may be concluded that the $\alpha - \beta$ -transformation interval of La in heating is 325-375°, in cooling as low as 250-200°, depending appreciably on the rate of cooling (to a minor degree on the rate of heating, also). There are 5 figures, and 8 references (3 Russian-language Soviet, 2 Russian-language translations of an English-language rare-earth paper by F. H. Spedding, and A. H. Daane, circa 1953-54, and one by Smith, K. Carlson, and Speeding, circa 1954-55, 2 English-language and 1 presumably French-language papers).

ASSOCIATION: MIFI (Moscow Engineering Physics Institute).

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SAVITSKIY, YE.M.

35071
S/697/61/000/000/017/019
D228/D303

18.1200

AUTHORS: Sominskaya, Z. M., Nikitina, A. A., Tylkina, M. A., Sklyarenko, S. I. and Savitskiy, Ye. M.

TITLE: Galvanic coatings with rhenium-nickel, rhenium-cobalt, rhenium-chromium and rhenium-nickel-chromium alloys

SOURCE: Akademiya nauk SSSR. Institut metallurgii im. A. A. Baykova. Institut mineralogii, geokhimii i kristallokhimii redkikh elementov. Mezhduvedomstvennaya komissiya po redkim metallam. Vsesoyuznoye soveshchaniye po probleme reniya. Moscow, 1958. Reniy; trudy soveshchaniye. Moscow, Izd-vo AN SSSR, 1961, 209-213

TEXT: In this work the authors prepared stable galvanic coatings of various alloys -- Re-Ni, Re-Co, Re-Cr, Re-Ni-Cr -- and studied their properties. It is stated that, although scientists have obtained galvanic coatings of binary Re alloys, no previous attempt has been made to prepare films consisting of the ternary Re-Ni-Cr alloy. In the tests the coatings were applied to rods of Cu and

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S/697/61/000/000/017/018
D228/D303

Galvanic coatings with ...

Ni-Cr. The method of L. E. Netherton and W. L. Holt was followed
in the preparation of Ni-Re alloy coatings containing 19 - 86% Ni.
The experimental procedure is described together with those for the
preparation of Re-Co (19 - 32% Co) and Re-Cr (≤1% Cr) coatings. In
the case of the ternary alloy, containing 13.3% Ni and 5.4% Cr,
the authors electrolyzed material composed of $KReO_4$ 50, CrO_3 20,
$NiSO_4$ 100, H_2SO_4 75, and $(NH_4)_2SO_4$ 40 g/l at a temperature of 75°C
and a cathode current-density of 100 amp/dm^2. The analytical me-
thod employed to determine the alloys' composition is also des-
cribed. The hardness of the coating layers was measured on a ПТМ-3
(PTM-3) instrument with a diamond pyramid under loads of 100, 50,
and 20 g. Their thickness was estimated with the help of micropho-
tographic techniques. On the basis of their experimental data,
which are given in tables, the authors draw the following conclu-
sions: 1) There is no diffusion pene-tration of Re and its alloys
into the surface layer of the base material; 2) the coatings are
mostly quite dense, but the layers are not evenly distributed on

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Galvanic coatings with ... S/697/61/000/000/017/018
D228/D303

the surface of the specimens; 3) cracks observed in some coatings were probably formed under the severe machining conditions and high temperatures used to prepare the polished sections; 4) the microhardness determinations only yield tentative information which shows that the coatings are harder than the Cu and Ni-Cr base. There are 2 figures, 2 tables and 7 references: 2 Soviet-bloc and 5 non-Soviet-bloc. The 4 most recent references to the English-language publications read as follows: C. Joynd, Metal Ind., 34, 176, (1936); L. E. Netherton and W. L. Holt, J. Electrochem. Soc., 98, 106, (1951) and 99, 44, (1952); M. F. Qualey, US Pat. 2739108, (1956).

Card 3/3

S/137/62/000/009/009/033
A006/A101

AUTHORS: Dashkovskiy, A. I., Savitskiy, Ye. M.

TITLE: Temperature dependence of internal friction, modulus of shear and linear expansion of lanthanum and cerium

PERIODICAL: Referativnyy zhurnal, Metallurgiya, no. 9, 1962, 5, abstract 9I29 (In collection: "Metallurgiya i metalloved.chist. metallov", no. 3, Moscow, Gosatomizdat, 1961, 196 - 202)

TEXT: Investigations were made with La containing (in %) basic admixtures Nd 0.8, Pr 1.0, Fe 0.01 and Pb, Cd, Bi $< 3 \cdot 10^{-4}$, and Ce containing (in %) Nd 0.75, Pr 0.75, Fe 0.01 and Pb $< 1 \cdot 10^{-4}$. Internal friction and the modulus of shear were studied as functions of temperature, and dilatometric curves for these metals were obtained. Temperatures of allotropic transitions were determined, being 325 - 375°C for La and 700 - 720°C for Ce. The values of the modulus of shear for La and Ce are equal to 1,480 $\pm$ 50 and 1,350 $\pm$ 50 kg/mm^2, respectively. The coefficient of linear expansion is $5.45 \cdot 10^{-6}$ for α-La; $9.56 \cdot 10^{-6}$ for β-La and $9.75 \cdot 10^{-6}$ for α-Ce. The volumetric change in $\alpha \rightarrow \beta$-transition of La

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S/137/62/000/009/009/033
A006/A101

Temperature dependence of internal friction...

is 0.218% and in $\alpha \rightarrow \beta$-transition of Ce it is 0.453%.

A. Dashkovskiy

[Abstracter's note: Complete translation]

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22802

18.1246 1416, 1454, 3515

S/136/61/000/005/005/008
E111/E152

AUTHORS: Savitskiy, Ye.M., Terekhova, V.F., and Naumkin, O.P.

TITLE: Ultra-light lithium alloys

PERIODICAL: Tsvetnyye metally, 1961, No.5, pp. 58-61

TEXT: Of the three metals with density under unity, sodium, potassium and lithium, the latter is both the lightest and most suitable for use in alloys. Considerable use has been made of it for deoxidizing and degassing (Refs. 1-3) and in the USSR it has been used as an alloying addition in light alloys. The object of the present work was to see whether super-light lithium alloys could be produced by adding magnesium and aluminium, which would be suitable both mechanically and in corrosion resistance for use in instruments and construction materials. For preparing binary magnesium-lithium alloys, lithium was fused under a LiCl + KCl flux and then magnesium was added, the temperature not exceeding 700 °C. For high-lithium aluminium alloys the same procedure was used, but if the lithium content was low it was added to fused aluminium. Melting was effected in armco-iron crucibles and after removal of flux alloys were poured into copper moulds. The ingots

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22802

S/136/61/000/005/005/008
E111/E152

Ultra-light lithium alloys

were extruded at 200-240 °C to 10-mm diameter rods, the extrusion flow pressure decreasing from 70 to 30 kg/mm^2 with increasing lithium content. Alloy compositions and densities (determined by apparent loss in weight in paraffin) are given in Table 1 (where headings of first and second columns are "alloy compositions, % by weight from charge composition" and "density, g/cm^3", respectively; words in first column are "silumin"). Five alloys with densities 1.05-1.30 g/cm^3 were studied further. Their coefficient of thermal expansion is given in Table 2 (where the second column is headed "coefficient of linear expansion at -85 to 0 °C, degree^{-1} x 10^6"; the footnote being "for calculating the coefficient the average of the length change on heating and cooling was taken"). The mechanical properties of deformed (extent not given - abstractor) alloys are given in Table 3 (where column headings are: 1) composition, % by weight; 2) hardness HV, kg/mm^2; 3) compression strength kg/mm^2; 4) relative contraction in compression; 5) nature of fracture; 6) tensile strength kg/mm^2; 7) relative reduction in cross-sectional area, %; 8) specific strength. In column 5 alloys 1, 2, 4, "ductile, no fracture test", the others, "brittle". The footnote to column 8 reads "specific

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E111/E152

Ultra-light lithium alloys

strength of magnesium 7.4, aluminium 2.3, lithium 2.2". Corrosion resistance in 3% aqueous NaCl (weight loss, g/m^2.hour) and in 90% humidity air (weight gain, g/m^2.day) is given in Table 4. In this table the heading of the 1st column is "composition, % by weight", 2nd and 3rd columns the two corrosion parameters given above; words in 2nd column "reaction with solution". The authors recommend ternary alloys with 7-15% Al, 15-25% Li and 60-80% Mg as structural alloys when lightness is needed; alloys with densities below unity can be used as a filler for tubes to make them rigid and yet light, as vibration absorbers under oil in instruments, and for other purposes.
There are 1 figure, 4 tables and 5 references: 4 Soviet and 1 English. The English language reference reads:
Ref.3: Robert S. Busk, J. of Metals, Vol.188, No.7, July 1950.

Card 3/6

18.8200 1045 1413 4016

30903
S/180/61/000/005/015/018
E021/E180

AUTHORS: Savitskiy, Ye.M., and Dashkovskiy, A.I. (Moscow)

TITLE: Investigation of internal friction as a method of physico-chemical analysis of metallic alloys

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Otdeleniye tekhnicheskikh nauk. Metallurgiya i toplivo. no.5, 1961. 96-100

TEXT: Results are given of measurements of internal friction on several metals and binary alloys, in an attempt to establish a relationship between internal friction, temperature and composition. Internal friction was measured by the damping of free torsional vibrations of low amplitude and 1 - 5 c.p.s. frequency and by the damping of free bending vibrations with resonant frequency. Metals showing polymorphic modifications (iron, uranium, zirconium, titanium, lanthanum and strontium) were first investigated. At the transformation temperature, there was a reversible change in the level of internal friction. For all the metals investigated, the internal friction was higher in the hexagonal close packed modification than in the cubic face-centred

X

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S/180/61/000/005/015/018
Investigation of internal friction... E021/E180

or body-centred forms. The internal friction method is a sensitive way of determining the temperature of polymorphic transformations. The effect of temperature on binary systems was studied on zirconium-niobium and zirconium-hafnium alloys. The internal friction method can be used for determining the beginning and the end of transformations in the solid state. It is also sufficiently sensitive to use in determinations of the limits of solubility in the solid state. The dependence of internal friction on composition was investigated for Zr-Hf, Zr-Ti, Zr-Nb and Zr-Sn systems. In the regions of solid solutions, the internal friction decreased with increase in alloying component. Two-phase alloys had a much lower level of internal friction than the pure components and a linear relationship with the concentration of alloying components was found. Internal friction can also be used for investigations of the non-equilibrium state. Construction of kinetic curves of internal friction against time can be used for the study of processes such as phase transformations and recrystallisation. N.S. Kurnakov is mentioned in the article for his contributions in this field.

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30903

S/180/61/000/005/015/018
E021/E180

Investigation of internal friction...

There are 6 figures and 12 references: 8 Soviet-bloc and 4 non-Soviet-bloc. The English language references read as follows:

Ref.3: C. Wert. Measurements on the Diffusion of Interstitial Atoms in BBC Lattices. J. Appl. Phys., 1950, v.21, No.11, 1196.

Ref.4: L.J. Dijkstra. Precipitation Phenomena in the Solid Solution of Nitrogen and Carbon in Alpha Iron below the Eutectoid Temperature. J. Metals, 1949, v.1, No.3, 352.

Ref.5: S. Harper. Precipitation of Carbon and Nitrogen in Cold-Worked Alpha Iron. Phys. Rev., 1951, v.83, No.4, 709.

X

SUBMITTED: March 1, 1961

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33177

S/180/61/000/006/007/020
E193/E383

18.9500 1521 1530 1418 1454

AUTHORS: Savitskiy, Ye.M., Kopetskiy, Ch.V., Pekarev, A.I. and Novosadov, M.I. (Moscow)

TITLE: Properties of single crystals prepared by electron-beam zone melting

PERIODICAL: Akademiya nauk SSSR. Izvestiya. Otdeleniye tekhnicheskikh nauk. Metallurgiya i toplivo, no. 6, 1961, 74 - 78

TEXT: The properties of high-purity W, Re, Ta, Mo, Nb and V were studied on single-crystal specimens prepared by electron-beam zone melting (5 - 8 passes at 8 - 10 cm/h) from sintered-powder compacts (2 - 5 mm in diameter) preliminarily degassed by vacuum treatment at 1 800 - 2 500 °C. It was confirmed by X-ray diffraction study that single crystals were, in fact, obtained by this method. No preferred crystal-growth orientation was observed and, in some cases, there was evidence of a slight (< 0.5°) block misalignment. The existence of sub-boundaries was revealed by metallographic examination. The results of hardness measurements are reproduced in Table 1, where columns

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X

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E193/E383

Properties of single crystals ....

I and II relate, respectively, to single crystals prepared by electron-beam zone melting and vacuum arc-melted buttons. UTS of Ta single crystals was 20.8 kg/mm^2, the corresponding figures for Mo and Nb being 41.7 and 17.2 kg/mm^2. In every case, the reduction in area amounted to ~100%. High plasticity of the zone-melted specimens was indicated also by the fact that single Mo crystals could be bent over a radius of 4-5 mm and could be reduced by cold-working to foil 0.2 - 0.3 mm thick or to wire 1 - 1.5 mm in diameter; Single V crystals could also be reduced to foil 0.15 mm thick. The purity of the single crystals of the metals studied was determined by determining the $\rho_{300°K}/\rho_{4.2°K}$ ratio, where ρ denotes the electrical resistivity at the respective temperatures. This ratio was 1 400 and 900, respectively, for single W and Mo crystals, the corresponding figure for these metals melted in a conventional manner being 10 - 20. The results of the present investigation indicated that high-purity single crystals could be prepared by electron-beam zone melting.

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E193/E383

Properties of single crystals ....

There are 2 tables, 5 figures and 6 references: 2 Soviet-bloc and 4 non-Soviet-bloc. The four English-language references mentioned are: Ref. 3: A. Calverley, M. Davis, R.F. Lever - J. Scient. Instrum., 1957, v.34, no. 4; Ref. 4: H.R. Smith - J. Metals, 1959, v. 2, no. 2; Ref. 5: H.W. Schadler - Trans. Metallurg. Soc. AIME, 1960, 218, 4, 649.

SUBMITTED: April 1, 1961

Table 1:

Металл Metal	Hv, кг/мм² kg/mm² I	Hv, кг/мм² kg/mm² II	Металл Metal	Hv, кг/мм² kg/mm² I	Hv, кг/мм² kg/mm² II
W	345	345—355	Mo	177	175—185
Re	112	220—250	Nb	79	130—140
Ta	76	150—170	V	91	170—190

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36441

S/137/62/000/003/107/191
A060/A101

18.1200

AUTHORS: Savitskiy, Ye. M., Baron, V. V., Yefimov, Yu. V.

TITLE: Study of the alloys vanadium-copper-carbon and vanadium-copper-aluminum

PERIODICAL: Referativnyy zhurnal, Metallurgiya, no. 3, 1962, 8-9, abstract 3I56 ("Tr. In-ta metallurgii. AN SSSR", 1961, no. 8, 120-127)

TEXT: Aluminothermic V (96.5%), carbothermic V (98%), and electrolytic Cu mark MO (MO) were taken as the starting materials. The alloys with Al were charged with an addition of Cu to the alumothermic V, and addition of C in the carbothermic V. The alloys were smelted in an arc furnace in a He atmosphere, homogenized at 1,000°C for 100 hours, and investigated by the methods of thermal, microscopic and X-ray structure analyses and by the measurement of the mechanical characteristics. The vertical sections were constructed of the V vertex of the system V - Cu - Al and V - Cu - C at a constant composition of 1.5% Al and C. The solubility of Cu in the aluminothermic V at 20°C is about 7.5%, and as the temperature increases so does the solubility, reaching a maximum (9.4% Cu) at 1,530°C. In the system V-Cu-Al one observes a wide region of lamination in

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S/137/62/000/003/107/191
A060/A101

Study of the alloys vanadium-copper-carbon ...

the liquid and the solid states, beginning at about 16% V. The monotectic temperature is equal to 1,530°C. The melting temperature of V in Cu is 1,120°C. The limiting solubility of Cu in alloys V-C at room temperature is about 1%, and at 1,575°C - about 3.5%. The addition of C raises the temperature of monotectic equilibrium from 1,530 to 1,575°C and extends the region of immiscibility. The lamination in V-Cu-C alloys is observed beginning from 11% Cu. Cu raises the hardness and lowers the ductility of V. In V-Cu-C alloys a second V-phase was found with a hexagonal lattice; one supposes that it is the γ-phase. There are 8 references.

Z. Rogachevskaya

[Abstracter's note: Complete translation]

Card 2/2

36403

S/137/62/000/003/109/191
A060/A101

18.1200

AUTHORS: Baron, V. V., Agafonova, M. I., Savitskiy, Ye. M.

TITLE: Structure and characteristics of alloys of the niobium vertex of the niobium-vanadium-aluminum system

PERIODICAL: Referativnyy zhurnal, Metallurgiya, no. 3, 1962, 9-10, abstract 3I62 ("Tr. In-ta metallurgii, AN SSSR", 1961, no. 8, 269-277)

TEXT: A study was made of the Nb vertex of the Nb-V-Al system at a content of up to 10% V and Al. The alloys were smelted from alumothermic V (96.5%), metalloceramic Nb (99.1%) and Al (99.99%) in an arc furnace in a He environment, were annealed at 1,100°C for 50 hours and hardened in the ТВВ-2 (TVV-2) furnace at 1,600°C. The investigation was carried out by the methods of thermal microscopic, and X-ray structure analyses, hardness measurements, microhardness measurement, fire-resistance determination. The smelting temperature of the alloys was determined by the drop test method. The isothermal section of the Nb vertex of the Nb-V-Al system at 20°C and the vertical section at a ratio of V : Al = 1.4 were constructed. At a content of 4% V in Nb at room temperature up

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A060/A101

Structure and characteristics ...

to 6% Al can be dissolved. V and Al raise the fire-resistance of Nb which is maximum in alloys with 3 - 8% V and ~1% Al and 1.8 - 2.2% V and 3.2 - 4.8% Al. There are 7 references.

Z. Rogachevskaya

[Abstracter's note: Complete translation]

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BARON, V.V.; YEFIMOV, Yu.V.; SAVITSKIY, Ye.M.

Structure and properties of the vanadium alloy angle in the system vanadium - aluminum - zirconium. Trudy Inst. met. no.8: 278-285 '61. (MIRA 14:10)
(Vanadium-aluminum-zirconium alloys—Metallography)
(Phase rule and equilibrium)

26794
S/129/61/000/009/002/006
E193/E380

18 1295

AUTHOR: Savitskiy, Ye.M., Doctor of Chemical Sciences, Professor

TITLE: Problems of rare-earth metals

PERIODICAL: Metallovedeniye i termicheskaya obrabotka metallov, 1961, No. 9, pp. 19 - 33 + 2 half-plates

TEXT: The growing importance of rare-earth metals and of two other elements (yttrium and scandium) of similar properties prompted the present author to write this review, based almost entirely on Soviet sources, including articles published by himself and his co-workers. After discussing the electron structure of rare-earth metals (REM) and their occurrence, the author describes some of their more important properties. Di_grams show the variation of at. volume, density, melting point, latent heat of melting and magnetic moment with at. number. Other properties such as temperature of polymorphic transformations, elastic modulus, electrical resistivity, hardness, compressive strength and plasticity are tabulated. Their application as deoxidising agents in melting of other metals

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Problems of rare-earth metals

and alloys is mentioned and the formation of REM hydrides, nitrides and carbides is discussed, together with the properties of these compounds. The application of REM in the atomic-power industry, in medicine and in X-ray technology is briefly commented upon and their use in both ferrous and non-ferrous metallurgy is discussed in greater detail. REM are very effective deoxidising, desulphurising, degassing and grain-refining agents, and as such are used to improve the quality of steels and cast irons. Addition of 1-2 kg ferro-cerium to 1 ton of Ni-Cr-Mo(or W) steel has such a beneficial effect that its properties in the as-cast condition are not worse than those of forged material of the same type. The addition of 4 kg of Fe-Ce-Mg alloy to 1 ton of molten cast iron fully converts the lamellar into spherodised graphite, doubles the UTS of grey cast iron and considerably increases its ductility as well as its impact and bending strength (in this connection, the author points out, savings amounting to millions of roubles could be made by using high-strength cast iron instead of steel). Since rational choice of composition of alloys and optimum heat-treatment conditions have to be based on the respective

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Problems of rare-earth metals

constitution diagrams, physical and chemical interaction of REM with other industrial materials is discussed. REM-bearing magnesium alloys are discussed with particular reference to the effect of REM on the high-temperature strength of the magnesium alloys. All REM-Al eutectics have a higher (635 - 640 °C) melting point than the Al-Si eutectic. Consequently, they are bound to have better high-temperature properties. To illustrate the effect of REM on other metals the constitution diagrams of the Fe-C, Fe-La, Cr-Ce, Ti-Ce and Nb-Ce systems are reproduced. It is pointed out that the effect of lanthanum on iron is not similar to that of cerium; this is probably due to the fact that Fe and La, which form a eutectic melting at 785 °C, form no intermetallic compounds. The beneficial effect of REM on chromium is attributed to the fact that they reduce the free nitrogen and oxygen content in this metal, thus lowering considerably the ductile-to-brittle transition temperature. REM, scandium and yttrium have a relatively high solid solubility in both α- and β- Ti; traces of α-Ti is stabilised by the addition of these elements, which considerably improve the mechanical properties of titanium

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Problems of rare-earth metals

alloys. This is illustrated in Fig. 10, showing the time-to-rupture (hours) of the ВТ3-1 (VT3-1) alloy containing: a - no alloying additions; б - 0.001% Ce; в - 0.01% Ce; г - 0.1% Ce; д - 0.2% misch-metal, tested at 500 °C under a stress of 40 kg/mm². The beneficial effect of REM on the mechanical properties of Nb, Mo and V is briefly discussed, the increase in ductility being attributed to deoxidising and denitriding. Super-plastic properties have been imparted to brass ЛС59-1 (LS59-1) (59% Cu, 40% Zn, 1% Pb) by the addition of 0.1% Ce, although the Ce-bearing alloys of this type tend to develop gas-porosity and cannot, as yet, be economically made on a commercial scale. Finally, the melting points of eutectics and compounds formed by REM with S, P, As, Pb, Bi and Sn are tabulated, and the possibility of utilising the high affinity of REM to low-melting point elements and the high-melting points of the resultant compounds in refining of metals is discussed. V.F. Terekhova is mentioned for her contribution.

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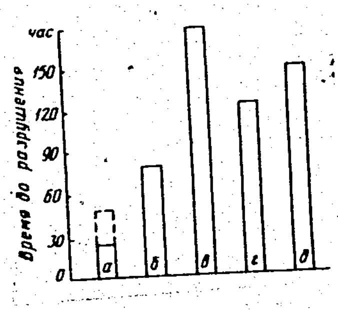
There are 12 figures, 4 tables and 29 Soviet references.

ASSOCIATION: Institut metallurgii AN SSSR (Institute of Metallurgy of the AS USSR)

Fig. 10:



KRIPYAKEVICH, P.I.; TYLKINA, M.A.; SAVITSKIY, Ye.M.

Compounds of hafnium with beryllium, their crystal structures and some properties. Zhur.strukt.khim. 2 no.4:424-433 Jl-Ag '61. (MIRA 14:9)

1. L'vovskiy gosudarstvennyy universitet imeni Iv.Franko i Institut metallurgii imeni A.A. Baykova AN SSSR.
(Hafnium-beryllium alloys)

20025

18920D 1418, 1145, 1454, 1045 S/070/61/006/001/003/011
E032/E514

AUTHORS: Kripyakevich, P. I., Tylkina, M.A. and Savitskiy, Ye.M.

TITLE: Crystal Structures of Hafnium-Beryllium Compounds (A Preliminary Communication)

PERIODICAL: Kristallografiya, 1961, Vol.6, No.1, pp.117-118

TEXT: It is stated that the hafnium-beryllium system has not so far been investigated. The alloys prepared by the present authors contained 0.05, 0.1, 0.25, 0.5, 2.0, 10.0, 20.0, 33.0, 62.5, 70.0, 80.0, 84.0, 91.0 and 95.5% by weight of hafnium. The alloys were prepared by alloying hafnium and beryllium in an argon atmosphere in a high frequency or an arc furnace. The specimens were then subjected to X-ray analysis. For some alloys the melting point, the hardness and the microhardness of the structural components were determined. The microhardness H_μ was determined with a load of 100 g to within ± 30 kg/mm^2 using a ПМТ-3 (PMT-3) device. It was found that the following four compounds are present in the system:

1) $HfBe_2$, structural type AlB_2, sp.gr. $C6/mmm_2 - D^1_{6h}$, $a = 3.783 \pm 0.002$, $c = 3.163 \pm 0.001$ Å, $c/a = 0.836$, $H_\mu = 980$ kg/mm^2;

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Crystal Structures of .....

2) $HfBe_5$, type $CaZn_5$, sp.gr. C6/mmm - D^1_{6h}, a = 4.534±0.010, c = 3.471±0.010 Å, c/a = 0.765, H_μ = 1340 kg/mm^2;

3) Hf_2Be_{17}, type U_2Zn_{17}, sp.gr. C6m2 - D^1_{3h}, a = 7.499±0.002, c = 21.905±0.006 Å, c/a = 2.921, H_μ = 1085 kg/mm^2;

4) $HfBe_{13}$, type $NaZn_{13}$, sp.gr. Fm3c - O^6_h, a = 10.005±0.002 Å, H_μ = 1200 kg/mm^2.

Thus, the Hf-Be system is close to the Zr-Be system from the crystal-chemical point of view. The latter also includes four compounds which are isostructural with the above compounds (N. C. Baenzinger, R. E. Rundle, Ref.2; J. W. Nielsen, N.C.Baenziger, Ref.3; A. Zalkin, R. C. Bedford, D. E. Sands, Ref.4). There are 4 references: all non-Soviet.

ASSOCIATIONS: L'vovskiy gosudarstvennyy universitet im. I.Franko (L'vov State University imeni I. Franko); Institut metallurgii im. A. A. Baykova AN SSSR (Institute of Metallurgy imeni A.A.Baykov AS USSR)

SUBMITTED: May 3, 1960

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88474

S/078/61/006/001/009/019
B017/B054

181210

AUTHORS: Baron, V. V., Savitskiy, Ye. M.

TITLE: Structure and Properties of Niobium - Aluminum Alloys

PERIODICAL: Zhurnal neorganicheskoy khimii, 1961, Vol. 6, No. 1, pp. 182 - 185

TEXT: The state diagram of niobium - aluminum alloys was studied by microscopic, thermal, and X-ray analyses, as well as by determinations of the micromelting point. Fig.1 shows the state diagram. Niobium of a purity of 99.0% (0.5% by weight of Ta, 0.02% by weight of Fe, 0.026% by weight of Ti, and 0.02% by weight of Si) and aluminum of a purity of 99.99% were used as initial materials. Table 2 gives the melting points of the alloys. The hardness of the alloys was measured with a ПМТ-3 (PMT-3) instrument under a load of 20 g, and the electric resistance with a ППТН-1 (PPTN-1) potentiometer at room temperature. Stability to corrosion was tested by treatment with water vapor at 400°C and 300 atm overpressure during 1000 hours. The following three compounds were found by studies of the fine structure and determinations of melting points: Nb_3Al, Nb_2Al, and

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88474

Structure and Properties of Niobium - Aluminum Alloys S/078/61/006/001/009/019
B017/B054

$NbAl_3$. Solubility of aluminum in niobium is about 6% by weight of aluminum at 2120°C, and 4.5% at room temperature. A solubility of niobium in aluminum was not observed. By addition of niobium, aluminum grains become smaller; solid solutions are formed on the basis of compounds Nb_3Al and Nb_2Al. The compounds Nb_2Al and $NbAl_3$ form a eutectic at 630 ± 10°C. $NbAl_3$ and Al form a low-melting eutectic (656°C). Hardness and electric resistance of niobium rise with increasing aluminum content. Alloys of niobium and aluminum show increased stability to water vapor at elevated temperatures and pressures (400°C, 300 atm overpressure). Compound Nb_3Al is a superconductor with a transition temperature of 17°K. N. Ye. Alekseyev determined the superconductivity. There are 2 figures, 2 tables, and 7 references: 1 Soviet, 1 US, 1 British, 1 French, and 3 German.

SUBMITTED: October 2, 1959

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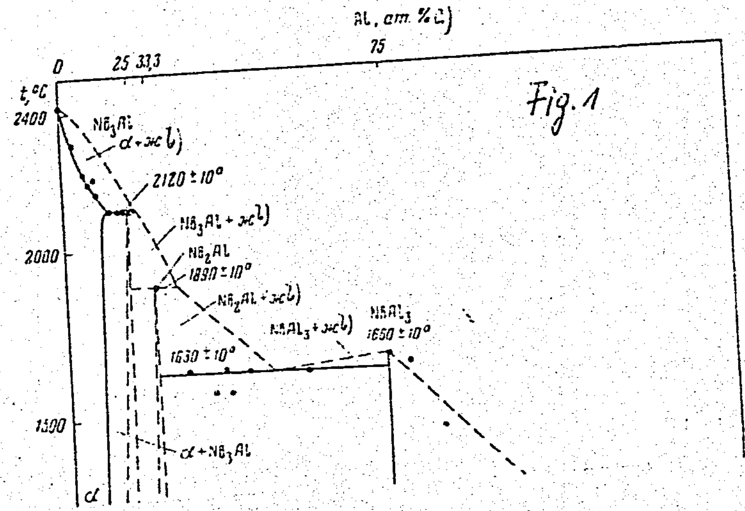

Fig. 1

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